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The Pteridophytes of Ohio

BY

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PUBLICATION COMMITTEE.

J. C. HAMBLETON. E. L. RICE. BRUCE FINK,

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INTRODUCTION.

Aside from their esthetic value, our native Pteridophytes are of little practical use, and this may be said of most of the species living in the world today. Ecologically considered, however, they are of considerable importance, and in the past geological ages also, the ferns and their allies were most important plants, contributing largely to the formation of coal.

It is hoped that this presentation of the Ohio species will enable all who so desire to become acquainted with these most graceful plant forms.

The keys have been made very complete so that one should be certain of the specimen in hand when the name has been traced out, except perhaps in a few of the more difficult genera. Only brief descriptions have been given in the catalog of species, and usually the characters enumerated in the keys have not been repeated.

The list of Ohio Pteridophytes, as it now stands, contains 61 species and a number of varieties, all being represented by herbarium specimens. Unless otherwise stated the records are based on specimens in the state herbarium of the Ohio State University. It is possible that several other species will be found in the state.

The census of species is as follows:

Ferns — 44 species.
Equisetums — 8 species.
Lycopods — 6 species.
Water-ferns — 1 species.
Quillworts — No species.
Selaginellas — 2 species.

Among those who have published lists of the Ohio ferns and fern allies, either separately or in some more extensive

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catalog, the following deserve special mention: John L. Riddell, Wm. S. Sullivant, Thos. G. Lea, Joseph Clark, J. S. Newberry, H. C. Beardslee, A. P. Morgan, Joseph F. James, Herbert L. Jones, E. L. Moseley, Wm. A. Kellerman, and Lewis S. Hopkins. Many other botanists have contributed either directly or indirectly to the knowledge of Ohio Pteridophytes, and the names of those who have presented specimens to the collection now in the State Herbarium would make a very extensive list.

Our forefathers considered ferns to be mysterious and uncanny things. They could not quite comprehend what seemed to be real plants without flowers or seeds. Thus many superstitions arose, the chief one of which, perhaps, was in regard to fern seed. It was supposed that the fern seed could be obtained only on the night of St. John's Eve, the 24th of June. Those who went to obtain the seed took a white cloth along in which to catch it. In some parts the fern seed was supposed to be in the keeping of the devil and could be obtained from him only at midnight. In some parts of England the general name for ferns was devil's bushes. On the night of St. John's Eve all the hosts of Elfland were also abroad in their greatest power. The fern would then produce a small blue flower at dusk and the wonderful seed would be ripe and fall from the plant at midnight. The fern seed was said to insure good luck. It would confer on one the strength of thirty or forty men. Another property was that it would enable the possessor to discover hidden treasure and to unlock anything that required opening. The sap of a plant from which fern seed is obtained would confer on the person taking the draft the blessing of eternal youth.

But the greatest property of all which the magic seed possessed was that by it one might become invisible. There is, however, no authentic record of anyone thus becoming invisible by its aid, so fern seed must have been about as scarce then as it is at present. This belief in the power of the fern seed to make men invisible arose in the age when the doctrine of signatures was taught and believed. Nature in giving particular shapes to leaves and flowers plainly taught our credulous ancestors for what diseases they were especially useful. A heart-shaped leaf was a cure for diseases of the heart; a leaf resembling the liver was for liver complaints; a bright-eyed flower was for the eyes; a foot-shaped flower was a certain cure for gout, etc. It was thus a clear conclusion that a plant with invisible reproductive organs would if properly used confer the property of invisibility. Shakespeare refers to this belief in the first part of King Henry IV., Act II., Scene 1: "We have the receipt of fernseed; we walk invisible." Ben Johnson alludes to the same superstition, as follows:

> "I had no medicine, Sir, to go invisible,
> No fern seed in my pocket."

Butler, in Hudibras, Part III., Canto 3, refers to the fern in a more scientific manner:

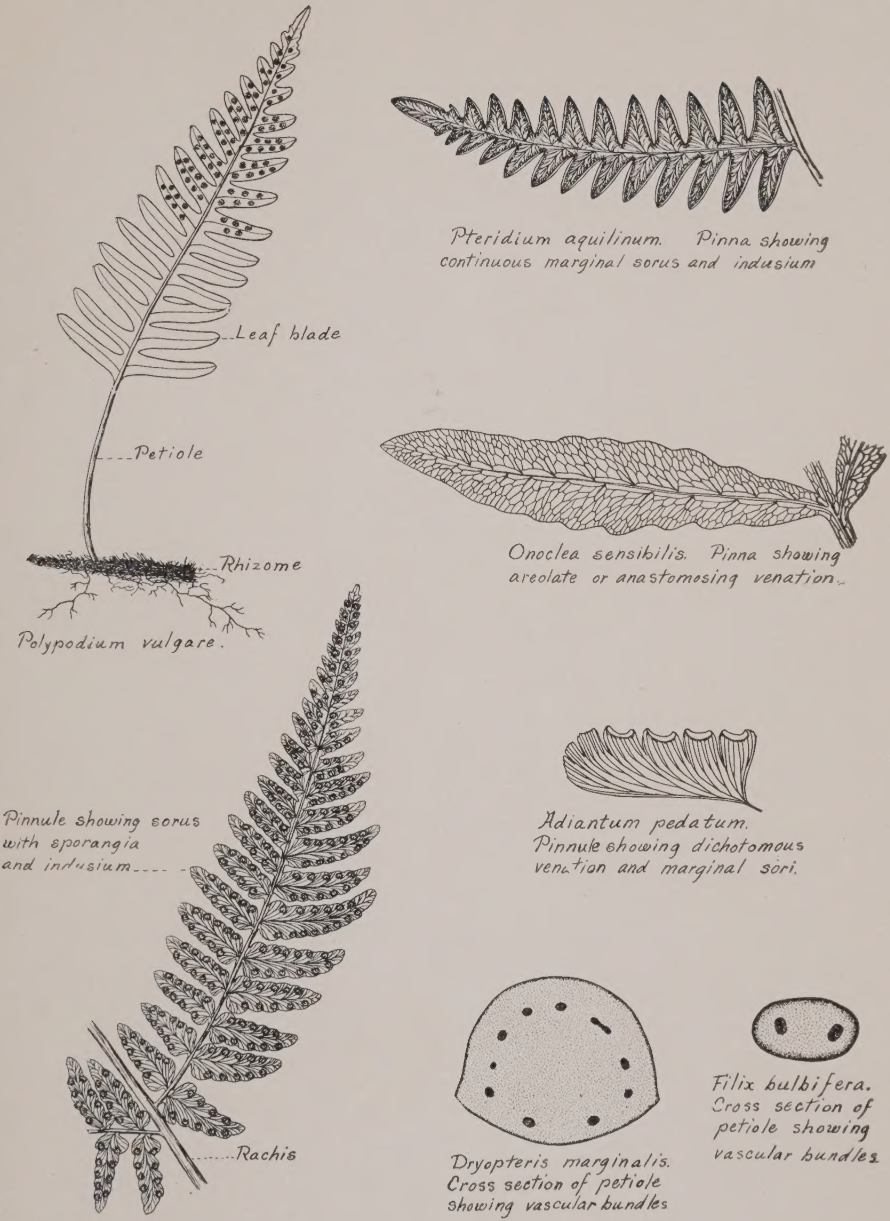
> 'Who would believe what strange bugbears
> Mankind creates itself of fears,
> That spring, like fern, that insect weed,
> Equivocally, without seed,
> And have no possible foundation
> But merely in th' imagination?"

It was customary in the seventeenth century to set fire to growing ferns under the belief that the practice would produce rain. The smoke of ferns was also believed to drive away snakes and other noxious creatures. In some places it was believed that by taking a bite from the leaf of the first fern that appeared in Spring the toothache would depart for a year. In the Tyrol, Osmunda is placed over the door for good luck. In some parts of England there was a practice of cutting the rhizome of a fern slantwise, when a picture of an oak tree could be made out; and the saying was that the more perfect the representation the more lucky the person would be who cut it. A certain species of spleenwort was supposed to make the spleen wither away. Thus in the Island of Crete the flocks and herds were said to be without spleens because they browsed on this herb. In some parts of the island where the plant did not grow, the cattle were said to have the usual spleens.

As stated above, the uses of ferns and fern allies in the household and the arts are insignificant. They are, however, much valued as ornamental plants. The species usually cultivated belong to the ordinary ferns and selaginellas. The Male Fern, Dryopteris filix-mas is officinal. It is an anthelmintic which is considered especially effective in removing tape-worms. It is not found in Ohio, but our Dryopteris marginalis is used in the same way as a taenifuge. Equisetum arvense is supposed to be injurious to horses, at least when in the form of hay. Pteridium aquilinum is supposed to be injurious to cattle and horses. Some of the scouring rushes, like Equisetum hyemale, are used for scouring utensils and polishing wood. The petioles of Adiantum pedatum are used by the Indians for basket-work.

The spores of Lycopodium clavatum and other species have a pharmaceutical use for coating pills and other adhesive surfaces. The spores are also used as baby powder to prevent chafing. The spore powder is highly inflammable and is used in the manufacture of fireworks and the artificial representation of lightning on the stage. Some species of Lycopodium, as L. obscurum, are extensively used for Christmas decorations.

A few of the ferns have a culinary value. The rhizome of the eagle fern, Pteridium aquilinum, is gathered and boiled by some savages and used as food. The succulent petioles of the eagle fern also furnish an article of food. They should be gathered just before the leaf-blade begins to unroll, and after cutting off the blade and the lower rather woody part and scraping off the bitter hairs and scales, they may be cooked much like asparagus or greens. The taste is not unpleasant and is agreeable to many persons. The petioles of the royal fern, Osmunda regalis, are used in the same way. Other ferns are also used as pot herbs. Among the more important are the cinnamon fern, Osmunda cinnamomea; Clayton's fern, Osmunda claytoniana; and the ostrich fern, Matteuccia struthiopteris. The leaves are collected just as they are unrolling and boiled as greens.



Polypodium vulgare.

Pteridium aquilinum. Pinna showing continuous marginal sorus and indusium

Onoclea sensibilis. Pinna showing areolate or anastomosing venation.

Adiantum pedatum. Pinnule showing dichotomous venation and marginal sori.

Dryopteris marginalis.

Dryopteris marginalis. Cross section of petiole showing vascular bundles

Filix bulbifera. Cross section of petiole showing vascular bundles

Drawings of the common parts of fern leaves, by Clara G. Mark.

CLASSIFICATION OF PTERIDOPHYTES.

Archegoniata. Archegoniates.

The intermediate plants; normally aerial plants but moisture-loving; always with an alternation of generations, the gametophyte comparatively large and often hermaphrodite in the lower forms but minute and always unisexual in the highest; the sporophyte small and without vascular tissue and permanently parasitic in the lower forms but large and with vascular tissue and becoming independent when mature in the higher; either homosporous or heterosporous, eusporangiate or leptosporangiate, never seed-producing; growing point commonly with a definite, two- or three-sided apical cell; stems sometimes having secondary thickening by means of a more or less perfect cambium or by division in the cortical cells; oosphere produced in an ovary of definite character called an archegonium and always cutting off a ventral canal cell; fertilization asiphonogamic, the spermatozoids swimming through water.

1. Sporophyte without roots, leaves or fibrovascular tissue...... ....Bryophyta. Mosses and Liverworts.
1. Sporophyte independent when mature with true roots, leaves, and fibrovascular tissue............................Pteridophyta. 2.
2. With one kind of nonsexual spores......Pteridophyta Homosporae.
2. With two kinds of nonsexual spores....Pteridophyta Heterosporae.

In this manual the Pteridophytes are still classified in their subkingdoms representing the lower and higher stages of development. They may more properly be classified according to their natural relationships into three great branches or phyla as follows:

1. *Ptenophyta.* About 4,500 known living species. Vascular seedless plants with comparatively large multiciliate sperms and usually with large, commonly compound leaves, the sporophylls not in cones.

Classes, Filices,
Hydropterides,
Isoeteae.

2. *Calamophyta.* 25 known living species. Vascular seedless plants with jointed stems and small whorled leaves with comparatively large multiciliate sperms, and with the sporophylls in cones.

Classes, Equiseteae,
Sphenophylleae (Fossil),
Calamarieae (Fossil).

3. *Lepidophyta.* 660 known living species. Vascular seedless plants with simple, usually small leaves covering the stem, with small biciliate sperms, and with the sporophylls in cones or sometimes forming zones alternating with the sterile leaves.

Classes, Lycopodieae.
Selaginelleae.

KEY TO THE CLASSES OF HOMOSPOROUS AND HETEROSPOROUS PTERIDOPHYTES OF OHIO.

1. With comparatively large, broad, compound or rarely simple, abundantly veined leaves; homosporous, the spores all of one kind; sporangia borne on the foliage leaves or on special sporangiophores.......................................I. Filices. Ferns.

1. With 4-foliate, slender-petioled leaves from a horizontal rhizome; or small, free-floating plants with small 2-ranked foliage leaves; heterosporous, the spores of two sizes, microspores and megaspores; sporangia in sporocarps........IV. Hydropterides. Water-ferns.

1. Leaves small, short, and scale-like, scattered or in whorls; or long, grass-like, and in a rosette; plants not floating; homosporous or heterosporous. 2.

2. With minute scale-like leaves in a whorl, forming sheaths at the nodes of the jointed stem; homosporous, the spores with appendages, the peltate sporophylls in cones.......................
...............II. Equiseteae. Horsetails and Scouring Rushes.

2. With simple, long, grass-like leaves containing a ligule and forming a rosette on a short 2- or 3-lobed stem; heterosporous, the sporangia in the bases of the leaves...........V. ISOETEAE. Quillworts.

2. With numerous, small, lanceolate, subulate, or scale-like, 1-nerved leaves covering the stem. 3.

3. Leaves without a ligule; homosporous, sporangia single in the axils of the sporophylls which are arranged in cones or in zones alternating with foliage leaves..........III. LYCOPODIEAE. Clubmosses.

3. Leaves with a ligule; green cells often with only 1 large chloroplast; heterosporous, the sporangia single in the axils of the sporophylls which are arranged in cones....VI. SELAGINELLEAE. Selaginellas.

SUBKINGDOM, PTERIDOPHYTA HOMOSPORAE.

Homosporous Pteridophytes; 4,500 known living species.

Plants in which the herbaceous or tree-like sporophyte, after the juvenile stage, has an independent existence with true fibrovascular tissue, roots, and leaves, and with a terminal growing point; homosporous and either eusporangiate or leptosporangiate. Gametophyte usually rather large, normally hermaphrodite although often unisexual; thalloid and green but sometimes tuberous and subterranean and without chlorophyll.

Class I. FILICES. Ferns. About 4,000 living species.

Sporophyte herbaceous or tree-like, usually with a horizontal rhizome, simple or branched; leaves usually large, alternate and mostly compound, rarely slender and grass-like; sporangia borne on the under side of the leaves or on simple or branched sporangiophores; eusporangiate or leptosporangiate; sporophylls not forming cones. Gametophyte comparatively large, tuber-like without chlorophyll and subterranean, or commonly developed as a flat, simple or branched thallus, hermaphrodite or unisexual; spermatozoids multiciliate.

KEY TO THE GENERA OF OHIO FILICES.

Required for identification — perfect leaves with the entire petioles, some of the leaves with sporangia which need not, however, be mature. The vascular bundles should be determined at or very near the base of the petiole. The number following the generic name refers to the list number.

1. Leaf blades areolate, the veins anastomosing to form a network. 2.
1. Leaf blades not areolate, the veins not anastomosing, but dichotomous or pinnate, and ending free. 5.
2. Leaf blades simple, entire, with a distinct sporangiophore with two rows of sporangia, vascular bundles in petiole 3-6.......... ....*Ophioglossum* (1).

2. Leaf blades compound or somewhat lobed, the sporangia on the blade or on distinct leaves. 3.

3. Leaves rooting freely at the long tapering apex, simple or somewhat lobed; sori linear or oblong; vascular bundles in base of petiole 2. ....*Camptosorus* (11).

3. Leaves not rooting at the tip, pinnatifid or pinnate. 4.

4. Sterile pinnae sharply serrate; vascular bundles in base of petiole 2 or numerous, sori oblong in chain-like rows........ ....*Woodwardia* (8).

4. Sterile pinnae coarsely toothed or lobed; vascular bundles in base of petiole 2; sori round, enclosed in the leaflet.....*Onoclea* (19).

5. Vascular bundles in base of petiole 3 or more. 6.

5. Vascular bundles in base of petiole 1 or 2, but additional brown or black sclerenchyma bundles may be present. 11.

6. Sporangia on a more or less branched sporangiophore distinct from the leaf blade; vascular bundles in the base of the common petiole in a ring...............................*Botrychium* (2).

6. Sporangia not on a sporangiophore distinct from the leaf blade. 7.

7. Leaflets with continuous marginal indusia; leaves large, ternate, with nectar glands in the axils of the main divisions; vascular bundles in base of petiole about 12, irregularly arranged... ....*Pteridium* (6).

7. Sori with special indusia or naked, not covered by the leaf margin; vascular bundles in base of petiole 10 or less. 8.

8. With oblong or linear sori in chains parallel to the midrib; leaflets areolate in the middle; vascular bundles in base of petiole 7-9. ....*Woodwardia* (8).

8. Sori round or roundish, indusia less than twice as long as broad. 9.

9. Pinnae strongly auricled on the upper side at the base; fertile part of leaf specialized; indusium orbicular, peltate, without a sinus, fixed by the centre; vascular bundles in base of petiole 4-5. ....*Polystichum* (12).

9. Pinnae not auricled. 10.

10. Leaves simply pinnatifid; petioles articulated to the rhizome; sori naked, circular; vascular bundles in base of petiole 3... ....*Polypodium* (4).

10. Leaves 2- or more- pinnatifid or pinnate; indusium reniform or if orbicular with a narrow sinus..................*Dryopteris* (13).

11. Sporangia borne on specialized leaves, without foliage leaflets, on specialized pinnae at the middle or end of the foliage leaf, or on special sporangiophores distinct from the leaf blade. 12.

11. Sporangia on leaflets of ordinary foliage leaves, some or all of which may be fertile. 14.

12. Vascular bundles 2, often uniting, not incurved; sori on specialized leaves; pinnules pinnately veined, barely dichotomous.......... ....*Matteuccia* (18).

12. Vascular bundles strongly incurved, venation distinctly dichotomous. 13.

13. Sporangiophore distinct, usually on a stalk beside the leafblade; sporangia large, globular........................*Botrychium* (2).

13. Sporangia on specialized leaflets at the end or sides of the foliage leaves; or on specialized leaves; vascular bundle in base of petiole 1; leaves 2 or more feet long, bipinnatifid or bipinnate..*Osmunda* (3).

14. Sori with marginal indusia formed by the more or less altered and reflexed edge of the leaflet or its lobes. 15.

14. Sori with special indusia or naked, not covered by the margin of the leaflet. 16.

15. Only the tips of the lobes of the leaflets reflexed as indusia. ....*Adiantum* (5).

15. Entire margin of the leaflets reflexed to form the indusium, rarely interrupted. ....*Pellaea* (7).

16. Sori linear or oblong, indusia more than twice as long as broad. 17.

16. Sori round or roundish, indusia less than twice as long as broad. 18

17. Sori elongated, on the upper sides of the veins..... *Asplenium* (9).

17. Sori and indusia somewhat curved, sometimes horseshoe-shaped many of them crossing the veinlet, sometimes with 2 sori placed back to back; leaves bipinnatifid or bipinnate in our species, usually 2-3 feet long..............................*Athyrium* (10).

18. Sori naked, circular; petiole with 2 united vascular bundles; leaf blades triangular or ternate...................*Phegopteris* (14).

18. Sori with indusia, sometimes inferior and obscure; leafblade not triangular nor ternate. 19.

19. Indusium superior, cordate or reniform, attached by the sinus. ....*Dryopteris* (13).

19. Indusium convex, delicate and partly inferior, attached by a broad base at the side and enclosing the sorus like a hood; leaves sometimes with brood-buds..........................*Filix* (15).

19. Indusium wholly inferior. 20.

20. Indusium roundish or stellate, delicate, cleft into narrow segments; leaves in our species usually not over 16 inches long. *Woodsia* (16).

20. Indusium cup-shaped, somewhat 2-valved; leaves in ours usually over 2 feet long...........................*Dennstaedtia* (17).

Subclass, EUSPORANGIATAE.

Sporangia arising from the tissues beneath the epidermis.

Order, *Ophioglossàles.*

Ophioglossàceae. Adder-tongue Family.

Sporophyte more or less succulent with fleshy roots; sporangia opening by a transverse slit, spores yellow. Gametophyte subterranean, without chlorophyll.

1. **Ophioglóssum** L. Adder-tongue.

Low plants with simple leaves and sporangia in two rows on a slender sporangiophore. Veins reticulate.

1. *Ophioglossum vulgàtum* L. Adder-tongue.

A low plant with a short rhizome and simple leaves, the sporangia borne on a spike-like sporangiophore. In moist meadows and thickets, on the ground. Rather generally distributed in Ohio, but local and not common.

2. **Botry'chium** Swz. Grape-fern.

Plants with a short erect rhizome and fleshy roots. Leaves pinnately or ternately divided or compound; sporangiophore branched. Veins ending free.

1. Leaf blade pinnate or ternate, sessile on the common petiole or on a stalk not more than 1 inch in length. 2.

1. Leaf blade ternate; on a stalk over 2 inches in length. 6.

2. Leaf blade more or less fleshy, pinnate or bipinnate, or if ternate then small, not much over 2 inches long. 3.

2. Leaf blade membranous, ternately decompound with three main sessile divisions, large; the sporangiophore stalked, usually 6 inches or more in length. Bud enclosed in a cavity at one side of the base of the petiole........................*B. virginianum.*

3. Sporangiophore stalked. leaf blade usually pinnatifid, pinnate or bipinnate, stalked or sometimes nearly sessile. 4.

3. Sporangiophore sessile or nearly so, leaf blade closely sessile on the common petiole, 3-lobed and 2-pinnatifid............*B. lanceolatum.*

4. Leaf blade simply pinnatifid or pinnate. 5.

4. Leaf blade 2-pinnatifid or 2-pinnate, with narrow segments, occasionally in 3 divisions...........................*B. neglectum.*

5. Leaf blade usually short-stalked, pinnatifid or nearly entire; sporangiophore nearly simple or little branched.............*B. simplex.*

5. Leaf blade pinnate, nearly sessile, with fan-shaped segments; sporangiophore much branched..............................*B. lunaria.*
6. Leaf segments obliquely ovate or oblong, large, ½-1 inch long..*B. obliquum.*
6. Leaf segments finely laciniate, narrow, ⅛ inch wide or less...*B. dissectum.*

1. *Botrychium lunària* (L.) Sw. Moonwort.

A fleshy low plant with the leaf blade usually sessile at about the middle of the common petiole. Lobes of the leaf fan-shaped, 3-8 pairs. Sporangiophore much branched. In open places and fields. Northern. Lake Co.

2. *Botrychium simplex* Hitch. Little Grape-fern.

A delicate plant, 4-10 inches high with the leaf blade simply lobed or pinnatifid and usually short-stalked at about the middle of the common petiole, the lobes only slightly fan-shaped. In moist rich woods and meadows. Cedar Point, Erie Co.

3. *Botrychium negléctum* Wood. Matricary Grape-fern.

A plant 6-12 inches high often very fleshy; leaf blade ovate or oblong 1-2 pinnatifid or pinnate with obtuse divisions and narrow toothed segments. Sporangiophore 2-3-pinnate. (*B. matricariaefolium* A. Br.) In rich grassy woods and swamps. Portage, Ashtabula, Cuyahoga and Erie Cos.

4. *Botrychium lanceolàtum* (Gmel.) Angs. Lanceleaf Grape-fern.

A somewhat fleshy plant with a closely sessile leaf blade near the summit of the common petiole. Blade triangular and ternately twice pinnatifid. Sporangiophore sessile or short-stalked, 2-3-pinnate. In rich woods, meadows and swamps, on the ground. Geauga and Portage Counties.

5. *Botrychium oblìquum* Muhl. Oblique Grape-fern.

Plant robust, the leaf blade on a long stalk arising from near the base of the common petiole, ternate, the segments obliquely ovate or oblong. Sporangiophore long-stalked, much branched. Low woods and open places. Root contraction very prominent. General in Ohio.

6. *Botrychium dissèctum* Spreng. Cutleaf Grape-fern.

Plant rather robust with a much dissected leaf blade on a long stalk from near the base of the common petiole, the sporangiophore also long-stalked and much branched. Ultimate segments laciniate. Roots with prominent contraction. In various habitats, meadows and open woods. General in the state.

7. *Botrychium virginiànum* (L.) Sw. Virginia Grape-fern.

A plant from 1-2 feet high with a large, ternate, membranous leaf, sessile on the common petiole; sporangiophore long-stalked, 2-3-pinnate. In rich woods and moist rocky ravines. General and common in the state.

Subclass, LEPTOSPORANGIATAE.

Sporangia arising from the epidermal cells commonly stalked.

Order, *Filicàles.*

Osmundàceae. Royal Fern Family.

Large ferns with 1-2-pinnate leaves with free veins. Sporangia large, globose, without a ring.

3. **Osmúnda** L.

Tall ferns, growing in moist places, swamps or bogs, in large rosettes or crowns. Sporangia opening by a longitudinal cleft into two halves.

1. Leaves truly bipinnate fertile at the apex; veins in the pinnules once and twice dichotomous.................................*O. regalis.*
1. Sterile leaves bipinnatifid. 2.
2. Leaves with fertile pinnae in the middle, sterile pinnae without a tuft of tomentum at the base......................*O. claytoniana.*

2. Fertile leaves distinct from the foliage leaves; pinnae of the foliage leaf with a distinct tuft of tomentum at the base; veins in the pinnules regularly once dichotomous.............*O. cinnamomea.*

1. *Osmunda regàlis* L. Royal Fern.

A large fern with stout rhizome bearing a cluster of bipinnate leaves, 2-6 feet high. Sporophylls with the upper pinnae developed as a specialized sporangiophore. In swamps and wet places. General in Ohio.

2. *Osmunda claytoniàna* L. Clayton's Fern.

A large fern with stout rhizome bearing a rosette of 2-pinnatifid leaves 2-6 feet high. Sporophylls with specialized spore-bearing pinnae in the middle. In moist places. General in the state.

3. *Osmunda cinnamòmea* L. Cinnamon Fern.

A large fern with a very large, widely creeping rhizome bearing a rosette of large sterile leaves with brown colored sporophylls within. Petioles with abundant tomentum when young. Veins in the pinnules regularly once dichotomous. In swamps and wet places. General.

Polypodiàceae. Polypody Family.

Ferns of various habits, the rhizome horizontal or erect. Sporangia opening transversely and provided with a vertical ring.

4. **Polypòdium** L. Polypody.

Ferns with creeping rhizomes articulated petioles and pinnate or simple leaves. Sori hemispherical without indusia. Veins free.

1. Leaves glabrous; plant green..........................*P. vulgare.*
1. Lower surface of the leaf densely scaly; plant grayish........
....*P. polypodioides.*

1. *Polypodium vulgàre* L. Common Polypody.

Rhizome widely creeping, densely covered with brown scales. Leaves evergreen, glabrous, with light-colored petioles. On rocks and rocky banks. General in the eastern half of the state.

1. *Polypodium polypodioìdes* (L.) Hitch. Gray Polypody.

Rhizome widely creeping covered with small brown scales. Leaves coriaceous evergreen, glabrous or nearly so above, densely covered with gray peltate scales below. On trees or occasionally on rocks. Adams and Hamilton counties.

5. **Adiántum** L.

Graceful ferns with much-divided leaves, with polished and shining petioles and dichotomous venation. Sori marginal under the reflexed tips of the pinnules.

1. *Adiantum pedàtum* L. Maidenhair Fern.

A fern with dichotomously forked leaves with pinnate branches, and with dark-brown or purplish petioles. On the ground in woods and on rocky hillsides. General and common.

6. **Pteri′dium Scop.**

Large and usually coarse ferns with marginal, continuous sori and indusia and free veins. (Pteris).

1. *Pteridium aquilìnum* (L.) Kuhn. Eagle-fern.

Rhizome horizontal and very extensive, the leaves ternate and large with nectar glands in the axils of the main divisions. The nectar is eaten by ants. In sunny places, especially on hillsides; sometimes also in the shade. Often called Bracken. General in Ohio.

7. **Pellàea** Link. Cliff-brake.

Rather small ferns growing on rocks, with marginal sori and indusia. Leaves pinnate or pinnatifid with dark-colored petioles. Veins free.

1. *Pellaea atropurpùrea* (L.) Link. Purple Cliff-brake.

Rhizome short and densely covered with hair-like scales. Leaves coriaceous, evergreen, simply pinnate or 2-pinnate below. Usually on limestone rocks. Ottawa, Stark, Franklin, Clark, Greene, Highland, and Adams counties.

8. **Woodwàrdia** Sw. Chain-fern.

Large ferns with pinnate or nearly 2-pinnate leaves and oblong linear sori arranged in chain-like rows parallel to the margins of the pinnae. Venation, partly areolate.

1. *Woodwardia virginica* (L.) Sw. Virginia Chain-fern.

Rhizome long, stout and chaffy. Sterile and fertile leaves similar in outline, pinnate, the pinnae linear-lanceolate. In swamps and wet ground. Ashtabula, Defiance, Geauga, Summit, Wayne, and Williams counties.

9. **Asplènium** L. Spleenwort.

Large or small ferns with leaves of various types, the sori linear or oblong oblique to the midribs or rachises. Veins free.

1. Leaves pinnatifid, or pinnate only near the base, tapering to a long point. 2.
1. Leaves once pinnate, with numerous pinnae. 3.
1. Leaves 2-3-pinnate or pinnatifid. 6.
2. Lobes of the leaf rounded or the lowest acuminate...*A. pinnatifidum.*
2. Lobes acute or acuminate, the tip of the leaf frequently rooting ....*A. platyneuron X Camptosorus rhizophyllus.* (*A. ebenoides.*)
3. Petioles pale, green or straw-colored; pinnae linear-lanceolate with a long point; leaves usually 2-3 feet long........*A. angustifolium.*

3. Petioles black or dark purple; pinnae mostly rather short and blunt. 4.
4. Pinnae auricled at the upper side of the base. 5.
4. Pinnae not auricled; alternate or opposite on the rachis, oval or roundish oblong, inequilateral.....................*A. trichomanes.*
5. Pinnae opposite, oblong; plants small; rachis dark brown or black. ....*A. parvulum.*
5. Pinnae partly alternate usually lanceolate; plants usually much larger; rachis chestnut brown or reddish..........*A. platyneuron.*
6. Petioles usually green, pinnules fan-shaped, usually incised.... ....*A. ruta-muraria.*
6. Petioles dark at the base, pinnules ovate-oblong, the lowest pinnately cleft into oblong or ovate cut-toothed lobes..........*A. montanum.*

1. *Asplenium pinnati′fidum* Nutt. Pinnatifid Spleenwort.

A fern with a short, chaffy, creeping rhizome and pinnatifid or sometimes somewhat pinnate leaves with long tapering points. Evergreen. On rocks. Licking, Fairfield, Hocking, and Lawrence counties.

2. *Asplenium platynèuron* (L.) Oakes. Ebony Spleenwort.

Rhizome short; leaves linear, 6-18 inches long, tufted, with purplish-brown shining petioles, and 20-40 pairs of lanceolate or subfalcate pinnae auricled on the upper side at the base. Evergreen on rocks and banks, especially in limestone soil. General except in the northeastern fourth of the state.

Hybridizes with *Camptosorus rhizophyllus.* The form known as *Asplenium ebenoides* Scott is probably this hybrid. It is found in Hocking county.

3. *Asplenium párvulum* Mart. & Gal. Small Spleenwort.

A small fern with short, chaffy rhizome and tufted, rather firm, linear-oblong or linear-oblanceolate leaves. Petioles blackish and shining; pinnae mostly opposite, oblong, obtuse, somewhat auricled on the upper side and nearly sessile. On limestone. Southern. In Adams county.

4. *Asplenium trichómanes* L. Maidenhair Spleenwort.

A small evergreen fern with short, nearly erect, chaffy rhizome and tufted linear leaves. Petioles purplish-brown and shining, with one vascular bundle in the base; pinnae oval or roundish-oblong, inequilateral, cuneate at the base, partly alternate and partly opposite. Usually on limestone and other rocks. General except in the northwestern fourth of the state.

5. *Asplenium angustifòlium* Mx. Narrow-leaf Spleenwort.

Rhizome stout and creeping, rooting throughout. Leaves in a rosette, lanceolate, about 2 feet long, with brownish or green petioles. Pinnae 20-30 pairs, linear-lanceolate. In moist woods. General in Ohio.

6. *Asplenium rùta-murària* L. Rue Spleenwort.

A delicate fern with short, ascending rhizome and tufted ovate or deltoid-ovate, glabrous, evergreen leaves, Petioles green, naked; pinnae and pinnules stalked. On limestone. Greene county.

7. *Asplenium montànum* Willd. Mountain Spleenwort.

Rhizome short and chaffy at the summit. Leaves tufted, evergreen, ovate-lanceolate, acuminate at the apex, 1-2-pinnate, delicate; petioles slender, naked, blackish at the base. On rocks. Hocking, Fairfield, and Summit counties. (Tuscarawas county, Hopkins.)

10. **Ath`yrium** Roth.

Sori more or less curved, sometimes horseshoe-shaped, often crossing to the outer or lower side of the fruiting veinlet; veins free. Our species large; leaves usually two feet or more in length. (*Asplenium.*)

1. Leaves 2-pinnatifid; segments blunt, scarcely crenate; vascular bundles of petiole 2............................*A. thelypteroides.*

1. Leaves 2-pinnate, pinnules acute, toothed or pinnatifid, vascular bundles 2....................................*A. filix-foemina.*

1. *Athyrium thelypteròides* (Mx.) Desv. Silvery Spleenwort.

A large fern with sinuous, creeping, rhizome. Leaves lanceolate in outline; petiole straw-colored, somewhat chaffy below. Segments of the pinnae blunt, scarcely crenate. (*Asplenium acrostichoides* Sw.). In rich moist woods. General in Ohio.

2. *Athyrium filix-fóemina* (L.) Roth. Common Lady-fern.

A large graceful fern with a rather slender creeping rhizome. Leaves broadly oblong-ovate or oblong-lanceolate, acuminate at the apex; pinnules oblong-lanceolate, incised or serrate. On the ground in rich moist woods and more open places. General in the state.

11. **Camptosòrus** Link. Walking-fern.

Slender evergreen ferns with tapering simple leaves rooting freely at the tips. Venation reticulate; sori linear or oblong.

1. *Camptosorus rhizophy'llus* (L.) Link. Walking-fern.

Rhizome chaffy, short, usually creeping; petioles light green; leaves auricled, the auricles sometimes rooting. On rocks, especially limestone. General in Ohio.

12. **Poly'stichum** Roth.

Coarse pinnate or bipinnate ferns with an erect or creeping rhizome and round sori. Indusium orbicular, superior, peltate; petiole not jointed; veins free.

1. *Polystichum acrostichòides* (Mx.) Schott. Christmas Fern.

An evergreen fern with a stout, creeping rhizome. Leaves once pinnate, petioles densely chaffy, pinnae half-halberd-shaped. Fertile leaves contracted at the summit. In woods and rocky places. General in Ohio.

The form, *P. acrostichoides schweinitzii* (Beck.) Small, has toothed or pinnatifid pinnae and has been found in Wayne county.

13. **Dryópteris.** Adans. Shield-fern.

Ferns with 2-3-pinnate or pinnatifid leaves and round sori with cordate-reniform indusia. Veins free; petioles not jointed. (*Aspidium*).

1. Vascular bundles of petiole 2, free or united; veins simple or once forked; leaves thin-membranous. 2.
1. Vascular bundles 5 or more; veins forking freely; texture of the leaf firmer. 3.
2. Lower pinnae very much reduced; vascular bundles usually bridged...*D. noveboracensis.*
2. Lower pinnae little smaller than the middle ones; veins once forked; vascular bundles 2, distinct..........................*D. thelypteris.*
3. Leaves 2-pinnatifid or 2-pinnate, the segments not spinnulose 4.
3. Leaves 2-pinnate or 3-pinnatifid, the segments spinulose-toothed. 6.
4. Sori marginal; petiole densely scaly below; indusia convex..*D. marginalis.*
4. Sori not marginal; petiole with few scales; indusia flat and thinnish. 5.
5. Vascular bundles in petiole 5; pinnae widest at the base. ....*D. cristata.*
5. Vascular bundles in petiole 7; pinnae widest at the middle. ....*D. goldieana.*
6. Leaves ovate-lanceolate, usually not narrowed below....*D. spinulosa.*
6. Leaves elongated-lanceolate, usually narrowed at the base..*D. boottii.*

1. *Dryopteris noveboracénsis* (L.) Gr. New York Shield-fern.

Rhizome slender and creeping; leaves lanceolate, tapering both ways from the middle, 1-2 feet long or more, petioles more or less chaffy. On the ground in moist woods. General.

2. *Dryopteris thely′pteris* (L.) Gr. Marsh Shield-fern.

Rhizome slender and creeping; leaves lanceolate or oblong-lanceolate, scarcely narrower at the base than at the middle, usually two to four feet long. In swamps and marshes. General.

3. *Dryopteris cristàta* (L.) Gr. Crested Shield-fern.

Rhizome stout and densely chaffy; leaves evergreen, linear-oblong or lanceolate, acuminate, gradually and slightly narrowed at the base, rather firm, one to three feet long; pinnae lanceolate or triangular ovate, acuminate; petiole with large scales. In moist woods and swamps. General.

The form *D. cristata clintoniana* (Eat.) Und. has oblong-lanceolate pinnae which are broadest at the base. Wayne county. (Geauga county, Hopkins.)

4. *Dryopteris goldieàna* (Hook.) Gr. Goldie's Shield-fern.

Rhizome stout and chaffy; leaves broadly ovate, rather firm, two to four feet long; petioles chaffy at least below. In rich woods. Rather general, but no specimens from the southern third nor from the northeastern counties.

5. *Dryopteris marginàlis* (L.) Gr. Marginal Shield-fern.

Rhizome ascending, stout with brown shining scales; leaves evergreen, ovate-oblong or ovate-lanceolate, subcoriaceous, two to three feet long; petiole chaffy; sori near the margin of the segments. In woods or on rocks. General in Ohio and common.

6. *Dryopteris spinulòsa* (Retz.) Ktz. Spinulose Shield-fern.

Rhizome chaffy; leaves evergreen, ovate-lanceolate, the pinnae oblique to the rachis; pinnae elongated-triangular; petiole with a few deciduous scales; indusium glabrous. In rich woods. General in Ohio.

The form, *D. spinulosa intermedia* (Muhl.) Und., has oblong-lanceolate spreading pinnae and the indusium beset with stalked glands. Rather general in Ohio.

The form, *D. spinulosa dilatata* (Hoffm.) Und., with broadly ovate or triangular-ovate, commonly three-pinnate leaves and glabrous indusia has been found by Hopkins in Tuscarawas county.

7. *Dryopteris boòttii* (Tuck.) Und. Boott's Shield-fern.

Rhizome ascending; leaves elongated-oblong or lanceolate, thin, acuminate at the apex, slightly narrowed at the base; petiole scaly at least below; pinnae lanceolate, long-acuminate, broadest at the base; pinnules very obtuse, the lower pinnatifid; indusium minutely glandular. In woods. Geauga county. (Wayne county, Hopkins).

14. **Phegópteris** Fee. Beech-fern.

Medium-sized ferns with 2-3-pinnatifid or ternate leaves and small round sori without indusia. Veins free.

1. Leaves 2-pinnatifid, triangular pinnae sessile; rachis winged. 2.
1. Leaves ternate with the three nearly equal divisions petioled; rachis wingless...*P. dryopteris.*
2. Leaves longer than broad, usually dark-green; upper part of the petiole usually pubescent.........................*P. phegopteris.*
2. Leaves as broad as long or broader, usually light-green; petiole mostly smooth...............................*P. hexagonoptera.*

1. *Phegopteris phegópteris* (L.) Und. Long Beech-fern.

A fern with a slender, creeping, somewhat chaffy rhizome. Leaves triangular, mostly longer than broad, acuminate and pubescent. Pinnae broadest above the base, pinnately parted very nearly to the rachis into oblong obtuse, entire segments, the lower pair deflexed. (*P. polypodioides* Fee). In moist woods. Rather general but apparently local.

2. *Phegopteris hexagonóptera* (Mx.) Fee. Broad Beech-fern.

A fern with a creeping, chaffy, somewhat fleshy rhizome. Leaves triangular, as broad as long or broader, slightly pubescent, acuminate at the apex; the lowest pair of pinnae broadest near the middle, pinnately parted into linear-oblong, obtuse segments. In dry rich woods. General in the state.

3. *Phegopteris dryópteris* (L.) Fee. Oak-fern.

A fern with a creeping rhizome and thin, broadly triangular ternate leaves. Petioles slender, chaffy near the base; the three main divisions of the leaf stalked. In most woods and swamps. Geauga, Lake, Ashtabula, and Wayne counties.

15. **Fi'lix** Adans. Bladder-fern.

Delicate ferns with 2-4-pinnate leaves and slender petioles. Sori roundish on the backs of the free veins; indusium hood-like and attached by a broad base partly beneath the sorus. (*Cystopteris*).

1. Leaves broadest at the base, elongated into a tapering point, bearing brood-buds beneath; vascular bundles of the petiole oval or flat...*F. bulbifera.*
1. Leaves scarcely broader at the base, short-pointed, without brood-buds; vascular bundles of the petiole rondish..........*F. fragilis.*

1. *Filix bulbi'fera* (L.) Und. Bulbiferous Bladder-fern.

Ferns with a short rhizome and elongated leaves lanceolate with a broad base, 2-3-pinnatifid or pinnate, the pinnules crowded. Rachis wingless bearing fleshy brood-buds. On moist rocks, especially limestone. General in the state but no specimens from the northwest.

2. *Filix frágilis* (L.) Und. Fragile Bladder-fern.

Ferns with a short rhizome and thin oblong-lanceolate, 2-3-pinnatifid or pinnate leaves slightly tapering below; pinnae lanceolate-ovate, irregularly pinnatifid. Rachis margined or winged, without brood-buds. On rocks and in moist grassy woods and ravines. General. The variety, *F. fragilis magnasora* (Clute), is reported from Wayne county by Hopkins.

16. **Woódsia** R. Br.

Small or medium-sized ferns with 1-2-pinnate or pinnatifid leaves and round sori, with inferior often evanescent indusia, on the backs of the free veins.

1. *Woodsia obtùsa* (Spreng.) Torr. Obtuse Woodsia.

A graceful evergreen fern with a short rhizome and broadly lanceolate, minutely glandular-pubescent leaves without joints in the petiole. Leaves 6-12 inches long. Indusium distinct splitting into jagged lobes. On rocks. Apparently common in the southern half of the state.

17. **Dennstaédtia** Bernh.

Large beautiful ferns with 2-3-pinnatifid leaves and small, globular, marginal or submarginal sori with membranous, cup-shaped, inferior indusia, which open at the top. Veins free. (*Dicksonia.*)

1. *Dennstaedtia punctilobula* (Mx.) Moore. Boulder Fern.

Rhizome creeping, not chaffy; leaves usually two feet long or more, thin and delicate, minutely glandular and pubescent; petiole pale green, stout, chaffless, and sweet-hay-scented, usually producing "leaf shoots" at its base. Growing under various conditions, especially on open hillsides. In the southern and eastern parts of the state. (Erie Co. Moseley Herb.)

18. **Matteúccia** Todaro.

Large ferns with erect rhizomes and large leaves in a crown. Sporophylls unlike the foliage leaves. Veins free. (*Onoclea.*)

1. *Matteuccia struthiopteris* (L.) Todaro. Ostrich Fern.

Rhizome stout and ascending, bearing a circle of sterile leaves with one or more sporophylls within. Leaves 2-6 feet high, bipinnatifid; sporophylls simply pinnate, the pinnae lobed. In moist thickets, especially along streams. Cuyahoga county. (Erie Co. Moseley Herb.)

19. **Onoclèa** L.

Coarse ferns with slender creeping rhizomes with leaves growing separately. Sporophylls unlike the foliage leaves. Veins forming small areolae.

1. *Onoclea sensi'bilis L.* Sensitive Fern.

Rhizome slender and rooting; leaves 1-4 feet high, broad, deeply pinnatifid; easily injured by frost; sporophylls bipinnate, persisting over winter, the pinnules unrolling at maturity. Young petioles red. In moist soil. General in Ohio.

Class II. EQUISETEAE. Horsetails and Scouring-rushes. 25 species.

Sporophyte perennial, herbaceous, with a rhizome, and with jointed, mostly hollow, simple or branched aerial stems which are either annual or perennial; vascular bundles in a circle; leaves reduced to sheaths around the joints, the sheaths toothed; sporangia borne on small peltate sporophylls arranged in whorls on a terminal cone; eusporangiate; spores with four narrow, strap-like, hygroscopic appendages. Gametophyte a small green thallus, usually unisexual; spermatozoids multiciliate.

Order, *Equisetàles.*

Equisetàceae, Horsetail Family.

20. **Equisètum** L. Horsetail. Scouring-rush.

1. Aerial stems annual, mostly with numerous branches except in some of the fertile stems; cones rounded not with a point; stomata scattered in the grooves. 2.

1. Aerial stems annual or evergreen, mostly unbranched, not tuberculate; cones with or without a point; stomata in a single regular row on each side of the groove, ridges with broad transverse or diagonal wart-like protuberances; sheaths funnel-shaped, constricted at the base..*E. laevigatum.*

1. Aerial stems evergreen, sheaths nearly cylindric or appressed; cones with a rigid point, stomata in regular rows; simple or sparingly branched. 5.

2. Aerial stems of two kinds, the succulent pale and brownish fertile ones sometimes appearing before the green sterile ones. 3.

2. Aerial stems, all alike with whorls of simple, usually short, branches; sheaths nearly cylindric; central cavity four-fifths the diameter..*E. fluviatile.*

3. Fertile stems soon withering, silex of the sterile stems in dots; branches of the sterile stems simple or compound......*E. arvense.*

3. Fertile stems branched and becoming green when old, only the apex withering. 4.

4. Branches of the sterile and fertile stems simple; silex of broad spinules on the ridges................................*E. pratense.*

4. Branches compound; silex of the fertile stems in 2 rows of prominent spinules....................................*E. sylvaticum.*

5. Stems low and slender, tufted, usually 5-10 grooved, central cavity one-third the diameter of the stem; sheaths 5-10-toothed.. ....*E. variegatum.*

5. Stems tall and rigid, rough and tuberculate, usually many-grooved; central cavity large, sheaths appressed. 6.

6. Ridges of the stem with 2 indistinct lines of tubercles; ridges of the sheath obscurely 4-carinate; stems less robust than in the following...*E. hyemale.*

6. Ridges with 1 line of tubercles; ridges of the sheath tricarinate; stem very stout....................................*E. robustum.*

1. *Equisetum arvénse L.* Field Horsetail.

Stems annual, 6 inches to 2 feet high, with scattered stomata, the fertile appearing in early spring before the sterile. Fertile stems not branched, soon withering; sterile stems green, much branched, rather slender. Stomata of the branches in two rows in the furrows. Quite a variable species. In moist soil and on hillsides and railroad embankments. General and abundant in the state.

2. *Equisetum praténse* Ehrh. Thicket Horsetail

Stems annual, 6-18 inches high, with scattered stomata, the fertile appearing in spring before the sterile. Fertile stems branched when old, only the apex withering. In sandy soil. Apparently general in Ohio.

3. *Equisetum sylváticum* L. Wood Horsetail.

Stems annual with scattered stomata, 1-2 feet high; the fertile appearing in early spring before the sterile, developing whorls of compound branches when old. Silex of the fertile stems in two rows of prominent spinules. In moist, sandy woods. Auglaize and Cuyahoga counties.

4. *Equisetum fluviátile* L. Swamp Horsetail.

Stems all alike, annual, 1-4 feet high, branched, the branches hollow and slender. Rhizome hollow. In swamps and wet places. Not common but to be found in most parts of the state in suitable habitats.

5. *Equisetum laevigàtum* A. Br. Smooth Scouring-rush.

Stems annual or perennial, 1-5 feet high, simple or little branched, pale green; sheaths funnel shaped. Stomata in regular rows; ridges with broad transverse or diagonal, wart-like protuberances. Cones pointed or without a point and merely acute. In sandy soil and on clay banks. General but apparently not common in Ohio.

6. *Equisetum variegàtum* Schleich. Variegated Scouring-rush.

Stems evergreen, slender, usually simple, 6-18 inches high. Central cavity small, stems 5-10 furrowed, with stomata in regular rows. In sandy places. Lake county. (Erie Co., Moseley herbarium.)

7. *Equisetum hyemàle* L. Common Scouring-rush.

Stems slender and stiff, evergreen, 1-4 feet high, sometimes branched, often with water or ice in the central cavity in winter; ridges with two indistinct lines of tubercles, ridges of the sheath obscurely 4-carinate. Cones pointed. In wet places and on banks, especially along streams. General in Ohio.

8. *Equisetum robu'stum* A. Br. Great Scouring-rush.

Stems very stout, sometimes branched, evergreen, 2-8 feet high, 20-48-furrowed, the ridges with a single series of siliceous tubercles. Ridges of the sheath 3-carinate. Cones pointed. In wet places and on banks. Apparently general in Ohio.

Class III. LYCOPODIEAE. Lycopods. 155 species.

Sporophyte perennial, herbaceous, with or without rhizome, the aerial stems upright or trailing; branching monopodial or dichotomous; leaves small, without a ligule, scattered on the stem, in two or many ranks; sporangia solitary on the upper surface of the leaves or in their axils, eusporangiate; sporophylls in bands alternating with the sterile leaves or arranged in spirals in terminal cones; spores small, not appendaged. Gametophyte small, sometimes subterranean, with or without chlorophyll, hermaphrodite; spermatozoids biciliate.

Order, *Lycopodiàles.*

Lycopodiàceae, Club-moss Family.

21. **Lycopòdium** L. Club-moss.

1. Sporangia borne on leaves similar to the foliage leaves, not in terminal cones. 2.
1. Sporangia or specialized, scale-like sporophylls which are arranged in terminal cones. 3.
2. Stems dichotomously branched only at the base. the branches long; leaves nearly linear and entire, rather short and rigid, but not uniformly ascending.................................*L. porophilum.*
2. Stems branched successively; leaves larger, widely spreading or reflexed, minutely toothed, and usually widest above the middle. ....*L. lucidulum.*
3. Leaves many-ranked on the cylindrical stem, not spreading into two ranks. 4.
3. Smaller branches flattened, or the leaves spreading into two ranks; stems with erect or ascending tree-like branches. 5.
4. Cones usually single, sporophylls much like the foliage leaves. ....*L. inundatum.*
4. Cones usually in twos or long peduncles, sporophylls very unlike the foliage leaves......................................*L. clavatum.*
5. Sterile stems with linear-lanceolate spreading leaves; cones erect, closely sessile......................................*L. obscurum.*
5. Sterile stems flattened, with fan-like ascending clusters of branches, leaves of two forms; cones clustered on long peduncles..... ....*L. complanatum.*

1. *Lycopodium poróphilum* Lloyd & Und. Rock Club-moss.

Stem dichotomously branched only near the base, the prostrate portion rooting freely; sporophylls in zones alternating with the sterile leaves; sterile leaves broadest at the base but very gradually tapering, entire or minutely denticulate; sporophylls minutely denticulate above the middle or entire, acuminate, only very slightly broadened above the middle. Plants evergreen, commonly with brood-buds. On sandstone rocks. Licking, Fairfield, Hocking, and Portage counties.

2. *Lycopodium lucídulum* Mx. Shining Club-moss.

Stems lax and successively, dichotomously branched, ascending or spreading, the plants evergreen, about six to twelve inches long; leaves dark green, shining, widest above the middle; sporophylls alternating with zones of sterile leaves. Plants commonly bearing brood-buds. On sandstone rocks and in cool, damp woods. General in the eastern half of the state.

3. *Lycopodium inundàtum* L. Bog Club-moss.

Stems long, creeping, flaccid, forking, and brittle, closely appressed to the earth; fertile stems erect, solitary, slender, terminating in short cones; leaves lanceolate or lanceolate-subulate, with hyaline margins. In sandy bogs. Portage county. (Hopkins).

4. *Lycopodium obscùrum* L. Tree Club-moss.

Stems erect, bushy, with fan-like branches, six to twelve inches high, from a slender subterranean, horizontal rhizome; leaves lanceolate-linear, entire, eight-ranked on the main stem; cones, one to ten on each plant, sessile. Plants evergreen. In moist woods. Ashtabula, Lake, Medina, Licking, Fairfield, and Defiance counties.

5. *Lycopodium clavàtum* L. Common Club-moss.

Stems creeping with similar short irregular ascending or decumbent densely leafy branches; leaves evergreen, linear-subulate, incurved, bristle-tipped; cones one to four on long peduncles. In rich woods. Geauga county. (Stark county, Hopkins).

6. *Lycopodium complanàtum* L. Trailing Club-moss.

Stems creeping extensively, with erect or ascending, fan-shaped, evergreen branches; leaves minute, appressed, four-ranked, the lateral rows with somewhat spreading tips; peduncle slender, dichotomous, with two to four cones. In woods. Cuyahoga, Carroll, Geauga, Licking, Fairfield, Hocking, and Lake counties. (Erie county, Moseley Herb; Wayne county, Hopkins.)

SUBKINGDOM, PTERIDOPHYTA HETEROSPORAE.

Heterosporous Pteridophytes. 700 living species.

Plants in which the sporophyte in the living species is herbaceous and after a brief embryonic stage has an independent existence with true fibro-vascular tissue, roots, and leaves; heterosporous, with microspores and megaspores which give rise to greatly reduced male and female gametophytes respectively; eusporangiate or leptosporangiate. Gametophytes always unisexual, with little or no chlorophyll, living on food stored in the spore and developing entirely inside of the spore wall or protruding only slightly through the side, the nonsexual spores often germinating before being discharged.

Class IV. HYDROPTERIDES. Water-ferns. About 75 living species.

Sporophyte with a horizontal rhizome or floating on the surface of the water; leaves alternate or whorled; microsporangia and megasporangia borne together enclosed in sporocarps, leptosporangiate. Gametophytes developing entirely within the spore walls or protruding only slightly, very short lived; spermatozoids large, spirally coiled, multiciliate.

1. Floating plants with minute leaves spreading into two ranks and with rootlets on the under side. *Azolla* (SALVINIALES.)
1. Leaves four-foliate with slender petioles. . . . . *Marsilea* (MARSILEALES.)

Order, *Salviniàles.*

Small floating plants with small leaves with globose sporocarps containing the megasporangia and microsporangia.

Salviniàceae. Salvinia Family.

Besides the native species below *Salvinia natans* (L.) Hoffm. is often kept in green houses and conservatories.

22. **Azólla** Lam.

1. *Azolla caroliniàna* Willd. Carolina Azolla.

Small greenish or reddish plants, deltoid or triangular-ovate in outline, pinnately branching, and free-floating, with minute two-lobed, imbricated leaves and delicate rootlets. Sporocarps of two kinds, the smaller ovoid containing a single megaspore, the larger globose, producing many stalked microsporangia, which contain several peculiar spore-containing masses beset with arrow-like processes. Sometimes covering large surfaces of water. Hamilton, Lucas, and Lake counties.

Order, *Marsileàles.*

Herbaceous perennials with slender creeping rhizomes and four-foliate or filiform leaves. Sporocarps borne on the petioles, containing both megasporangia and microsporangia.

Marsileàceae. Marsilea Family.

Water-ferns with four-foliate leaves on slender petioles; leaflets turning with the light.

23. **Marsi′lea** L.

1. *Marsilea quadrifòlia* L. European Marsilea.

Occasionally cultivated and found as a waif in Franklin county.

Class V. ISOETEAE. Quillworts. 60 species.

Sporophyte with a short tuberous stem with a peculiar type of secondary thickening and with long, erect, grass-like leaves which have a ligule; roots dichotomous; microsporangia and megasporangia large, borne singly, sunken in the expanded bases of the leaves, eusporangiate. Gametophytes very much reduced; spermatozoids spirally coiled, multiciliate.

Order, *Isoetàles.*

Isoetàceae. Quillwort Family.

24. **Isòetes** L.

Aquatic or marsh plants rooting in the mud, with a short 2-lobed or 3-lobed stem. One species of Quillwort might possibly be found in Ohio.

Class VI. SELAGINELLEAE. Selaginellas. 500 species.

Sporophyte dorsiventral or erect, with monopodial or apparently dichotomous branching and dichotomous roots; leaves small, opposite or spirally arranged, ligulate; cells often with a single chloroplast; sporophylls in bisporangiate cones, the eusporangiate microscorangia and megasporangia single in the axils of the sporophylls. Gametophytes small and short-lived; spermatozoids very minute, biciliate.

Order, *Selaginellàles.*

Selaginellàceae. Selaginella Family

25. **Selaginélla** Beauv.

Terrestrial annual or perennial plants with branching stems and scale-like leaves, either 4-ranked or many-ranked.

1. Leaves all alike and uniformly imbricated and many-ranked, the stem much branched in close tufts....................*S. rupestris.*
1. Leaves 4-ranked, shorter above and below, stipule-like, the lateral ones spreading into two planes; plants small and delicate...*S. apus.*

1. *Selaginella rupéstris* (L) Spring. Rock Selaginella.

Low, evergreen, tufted plants with occasional sterile runners and subpinnate branches, commonly curved when dry. Leaves rigid, appressed-imbricated, linear or linear-lanceolate, convex on the back, tipped with a distinct transparent point; cones sessile at the ends of the branches, strongly quadrangular. On dry rocks and sandy ground. Licking, Fairfield, and Hocking counties.

2. *Selaginella àpus* (L.) Spring. Creeping Selaginella.

Annual, light green, delicate plants with creeping, much-branched flaccid stems, angled on the face. Leaves minute, 4-ranked, membranous, of two kinds, spreading into two planes; cones obscurely quadrangular. In moist, shady places. Lake and Trumbull counties.

GLOSSARY.

Acuminate — Tapering gradually to the apex.

Acute — Sharp-pointed.

Anastomosing — Connecting so as to form a network.

Annual — Living but one year; yearly.

Annulus — The ring of cells partly or completely surrounding the sporangium.

Antheridium — The male organ of reproduction; a spermary.

Asiphonogamic — Not with a pollentube but having the spermatozoids discharged from the antheridium.

Archegonium — A female organ of reproduction; a special kind of ovary.

Areola — A space enclosed by anastomosing veinlets.

Areolate — Mapped off into small areas, or areolae.

Ascending — Growing obliquely upward.

Auricled — With ear-like lobes or appendages.

Bipinnate — Twice pinnate.

Bipinnatifid — Twice pinnatifid.

Bisporangiate — Having both microsporangia and megasporangia

Cambium — The cylinder of growing cells in some stems.

Carinate — With a keel or longitudinal ridge.

Caudate — Tailed; pointed like a tail.

Cell — The unit of plant and animal structure; usually consisting of a small mass of protoplasm containing a nucleus and with a cell wall.

Chlorophyll — The green coloring matter of plants.

Chloroplasts — The minute green, chlorophyll-bearing color bodies in the cell of a plant.

Ciliate — Provided with marginal hairs; having cilia.

Circinate — Rolled inward from the apex.

Clavate — Club-shaped.

Compound — Composed of several parts or divisions.
Cone — A primitive flower; a specialized branch of sporophylls whose apical growth has ceased.
Cordate — Heart-shaped.
Coriaceous — Leathery.
Crenate — With rounded teeth.
Crenulate — Minutely crenate.
Cuneate — Wedge-shaped.

Decompound — More than once compound.
Decurrent — Applied to an organ extending along the sides of another.
Deltoid — Broadly triangular.
Dentate — With outwardly projecting teeth.
Denticulate — Finely toothed.
Dichotomous — Two-forked.
Divided — Cleft to the base or to the midrib.

Emarginate — With a notched apex.
Entire — Without teeth, or serrations.
Epidermis — The external layer of cells of a plant.
Eusporangiate — Having the sporangia developed from sub-epidermal cells.

Falcate — Scythe-shaped.
Fertile — Bearing spores, gametes, or seeds.
Fibro-vascular — Containing fibers, vessels, and tubular cells.
Filiform — Thread-like.
Flaccid — Soft and weak.
Frond — Sometimes wrongly applied to the leaves of ferns.
Fruiting — Bearing spores, seed or fruit.
Gamete — A sexual cell.
Gametophyte — The sexual generation of plants.
Glabrous — Without hairs.
Gland — A secreting hair, or group of secreting cells.
Glaucous — Covered with a bluish or white bloom.

Habit — General aspect.
Habitat — The place where a plant grows.
Halberd-shaped — Same as hastate.
Hastate—Arrow-shaped with the basal lobes diverging.
Herbaceous — Having the texture of common leaves.
Hermaphrodite — An individual having both male and female sexual organs.
Heterosporous — Having microspores and megaspores.
Homosporous — Having only one kind of spores on the sporophyte.
Hyaline — Clear and translucent.
Hygroscopic — Readily absorbing and giving off water, by which means movements are produced.

Imbricate — Overlapping.
Incised — Cut into sharp lobes.
Indusium — The membranous covering of the sori in many species of ferns.
Inequilateral — With unequal sides.
Inferior — Situated or arising below other organs.

Laciniate — Cut into narrow segments or lobes.
Lamina — The blade of a leaf.
Lanceolate — Lance-shaped.
Leaflet — One of the divisions of a compound leaf.
Ligulate — Provided with or resembling a ligule.
Ligule — A strap-shaped organ, sometimes minute.
Linear — A long and narrow organ with the sides nearly parallel.
Lobed — Divided to about the middle or less.
Lunate — Crescent-shaped.

Megaspore — The larger of the two kinds of nonsexual spores produced by heterosporous plants.
Megasporangium — A sporangium which produces megaspores.
Membranous — Thin and rather soft and pliable.

Microspore — The smaller of the two kinds of nonsexual spores produced by heterosporous plants.
Microsporangium — A sporangium which produces microspores.
Midrib — The central rib of a leaf or other organ.
Mucronate — With a sharp, abrupt point.

Nectary — A nectar-secreting organ.
Node — The place where two internodes join, normally with one or more leaves.

Oblong — Somewhat longer than broad, with the sides nearly parallel.
Obovate — Inversely ovate.
Oösphere — The unfertilized egg; the female gamete.
Oospore — The fertilized egg.
Orbicular — Nearly circular in outline.
Ovary — The female organ of reproduction.
Ovate — Shaped like the longitudinal section of a hen's egg.

Palmate — Diverging like the fingers of a hand.
Panicle — An open cluster, consisting of more or less branching stems bearing fruit.
Peltate — Shield-shaped.
Perennial — Growing for many years.
Petiole — The stalk of a leaf.
Pilose — With long, soft hairs.
Pinna — The primary division of a pinnately compound leaf.
Pinnate — Leaves divided into leaflets or segments along a common axis.
Pinnatifid — Pinnately cleft to the middle and beyond.
Pinnule — A division of a pinna in a compound leaf.
Prothallium — Sometimes applied to the thalloid gametophytes of the Pteridophytes.
Pubescent — Hairy, especially with fine, soft hairs.

Rachis — The axis of a compound leaf, spike or raceme.
Receptacle — The part to which the sporangia are attached.
Reniform — Kidney-shaped.
Reticulate — Arranged as a network.
Revolute — Rolled backward.
Rhizoid — The filamentous, root-like outgrowths from the thallus of the gametophyte.
Rhizome — An underground stem.
Rootstock — Same as rhizome.

Sagittate — Shaped like an arrow-head.
Sclerenchyma — Bundles of thick walled fibers, in ferns usually brown or black.
Segment — One of the divisions of a pinnatifid or compound leaf.
Serrate — With teeth projecting forward.
Sessile — Without a stalk.
Silex — The silicious coating in the Equisetums.
Sinuate — With strongly wavy margins.
Sinus — The split or space between two lobes.
Sorus — A cluster of sporangia in the ferns.
Spatulate — Widened at the top like a spatula.
Spermatozoid — The male gamete.
Spinulose — With small, sharp spines.
Sporangiophore — A leaf or other organ bearing sporangia.
Sporangium — A spore-producing organ.
Spore — A modified reproductive cell.
Sporocarp — A carpel-like spore-bearing organ.
Sporophyll — A spore-bearing leaf.
Sporophyte — The nonsexual generation of plants.
Stellate — Star-shaped.
Sterile — Not producing spores or seeds.
Stipe — Sometimes used for the petiole of a fern leaf.
Stoma — The transpiring pores in the epidermis of the higher plants. (Plural, Stomata.)
Subcoriaceous — Somewhat coriaceous.
Subulate — Awl-shaped.

Succulent — Soft and juicy.
Superior — Above.

Ternate — Divided into three segments; arranged in threes.
Thalloid — Having the form of a typical thallus.
Thallus — The plant body of a thallophyte, or of the gametophyte of the Archegoniates.
Tomentose — Covered with dense wool-like hairs.
Truncate — Terminating abruptly by a nearly straight edge or surface.

Undulate — With wavy margins.
Unisexual — Having only ovaries or spermaries on one individual.

Vascular bundle — The conducting strands in the plant body composed of wood and bast.
Venation — The arrangement of the veins.
Vernation — The arrangement of the leaves in the bud.
Villous — With long, soft hairs not matted together.

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